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The Situated Multiliteracies Approach to Classroom Participation: English Language Learners' Participation in Classroom Mathematics Practices

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Guided by sociocultural theory and the theory of multiliteracies, learning is perceived as a shifting participation in practices, which is mediated by multiple physical and symbolic tools. Drawing on the situated multiliteracies approach, which integrates these two theories, the purpose of this ethnographic research is to examine English language learners' (ELLs) participation in mathematics practices in an urban Canadian classroom. This study describes ELLs' successful participation in classroom mathematics practices in relation to the context which supported their participation. I highlight the teacher's use of multiple languages and physical and symbolic tools, along with her affirmation of students' identities as multimodal users. The finding from this study calls for broadening the definition of language in content area classrooms and for embracing identities created through classroom interactions as an integral part of learning.

Key words: Sociocultural theory, multiliteracies, English language learners, classroom mathematics learning, multilingual classroom

In many urban cities in the world, schools are becoming multicultural and multilingual with the influences of globalization. As such, it is important to ensure equal educational opportunities for all learners, including learners with transnational and diverse linguistic experiences. In many countries, school-aged immigrant students tend to fall academically behind and at least 25% of

immigrant students did not attain the basic mathematics and reading proficiency level defined by the Programme for International Student Assessment (PISA) test (Organization for Economic Co-operation and Development, 2006). This report on PISA also demonstrated that gaps can be narrowed between immigrant students and non-immigrant peers, depending on the macro social contexts. For example, in Canada, where the present study was conducted, the report indicated that second generation immigrants performed better in subjects such as mathematics and reading, compared to their native peers. Thus, social contexts can influence these students' academic achievement and also their academic identities and possibilities. Although this type of large scale study suggests the importance of social contexts, it does not specify the local contexts that can facilitate and/or hinder these students' academic engagement. Examination of the role of local classroom contexts in students' engagement is essential for improving curriculum and pedagogy, because the classroom context can be transformed directly by both the teacher and students.

In the present study, I demonstrated the possibility of English language learners' (ELLs)¹ successful participation in classroom mathematics interactions by highlighting the role of various languages and multimodal resources. While there is a widespread notion that mathematics is a language-free subject, classroom mathematics instruction is in fact, conveyed through a unique and complex genre of language (Schleppegrell, 2007). Thus, examining instructional

¹ In the province of Ontario, Canada, where this study took place, the term *English language learners* was commonly used in the curriculum and in the school by referring to “students in provincially funded English schools whose first language is a language other than English, or is a variety of English and who may require focused educational supports to assist them in attaining proficiency in English” (Ontario Ministry of Education, 2007, p. 8).

interactions and ELLs' learning in mathematics classrooms is an important topic to pursue and examine. Previous research tended to investigate the aspect of language learning and the aspect of mathematics (or content) learning, separately. This is partially due to the fact that mathematics education and second language education have been established as separate disciplines, without much dialogue between the two areas.

In this paper, I will integrate insights from both the applied linguistics field and the mathematics education field. In order to connect the two, I incorporate sociocultural theory and the theory of multiliteracies as the *situated multiliteracies approach*. Subsequently, I will introduce my ethnographic research in Canadian elementary mathematics classrooms in a linguistically and culturally diverse, urban school. This research was conducted over the course of an academic year in order to follow the learning trajectory of newly arrived English language learners. With the use of video recordings, I highlighted the multimodal resources for communication amongst the students and with the teacher. This paper highlights ELLs' successful participation in classroom mathematics practices, where the teacher validated the use of multiple physical and symbolic tools for mathematics communication and affirmed these students' identities as multiliteracies users.

PEDAGOGY IN MULTILINGUAL CONTENT CLASSROOMS: OVERVIEW OF RESEARCH IN APPLIED LINGUISTICS

Due to the increase in the number of immigrant students whose first languages differ from the language of instruction, many teachers in content classrooms of urban cities are faced with the pedagogical challenge of providing content instruction, while also providing language instruction. In English-medium content area classrooms, ensuring ELLs' access to both English

language development and grade-level content knowledge has been recognized as one of the most significant pedagogical issues. In examining ELLs' learning in the school, Cummins (2000) highlights that academic language is a specific genre of language used in the school domain and can be different from everyday conversational language. As a result, ELLs continue to learn academic language even after they complete basic English as a Second Language (ESL) courses. Because ELLs will not acquire academic language proficiency by merely being exposed to English instruction, ensuring pedagogical opportunities which address ELLs' needs will be essential in developing their academic language in content area classrooms (e.g., Hansen-Thomas, 2009).

In the field of applied linguistics, researchers have examined language learning opportunities in various instructional settings (e.g., immersion, sheltered instruction, ESL classes, and mainstream classes) (Crandall, 1992; Janzen, 2008; Stoller, 2004). I will provide an overview of the research in this area, which is directly related to the main findings of this paper: characteristics of teacher language instruction and linguistically diverse students' identities.

Characteristics of Teacher Language Instruction in Content Area Classrooms

Previous research showed there was limited language instruction and metalanguage interaction in content area classrooms (Pica, 2002; Short, 2002). For example, in Short's (2002) study which was conducted in secondary sheltered social science classrooms, 20% of the teachers' utterances focused on linguistic forms and 95% of those utterances related to pronunciation and vocabulary comprehension. This research suggests that regular mainstream content classes did not provide linguistic minority students enough opportunities to develop language in a specific content area.

Pica's (2002) study also provides a similar picture of metalanguage interactions in content area classrooms. In the university literature classes examined in the study, interactions were limited in negotiation utterances and form-focused instruction, where a teacher and students could negotiate the students' language use. Teacher language instruction did provide lessons on specific structural rules and lexical meanings, but did not provide enough interactional support for second language development. Further examination of elementary content area classrooms is necessary to address the needs of diverse learners, especially because second language acquisition research tends to focus more on adults and university students and less on children and adolescents (Bunch, 2013).

Student Identity in Content Area Classrooms

There have been a growing number of studies focusing on the issue of identity in the field of applied linguistics (for review, see Block, 2007). The theoretical origins and definitions of identity in the field are not unified. Previous researchers have highlighted the relationship between language learning and the different dimensions of social identity, such as racial identities (e.g., Kubota & Lin, 2006), gender identities (e.g., Davis & Skilton-Sylvester, 2004), and bilingual and bicultural identities (e.g., Goldstein, 2003; Kanno, 2003).

The notions of identity in the field stem from various theoretical underpinnings. For example, drawing on poststructural theories, Norton (1997) defines identity as "how people understand their relationship to the world, how that relationship is constructed across time and space, and how people understand their possibilities for the future" (p. 410). This notion of identity allows us to examine issues such as "What is the learner's investment in the target language? How is the learner's relationship to the language socially and historically constructed?" (Norton, 1997, p. 411). From sociocultural theory, Toohey (2000) perceives identities as being

constructed in the practices of the communities in which they are situated. In the classroom context, Toohey examined how children of minority language backgrounds came to inhabit particular identities in the classroom and how those identities determined and affected what these children can learn. These different theories of identity are, in fact, not in conflict; rather, together they are able to shed light on various dimensions of identity and language learning.

There are studies focusing on the role of identity in interactions and language learning opportunities in the classroom. For example, in mainstream content area classrooms, where ELLs and non-ELL peers learn together, power dynamics among students should be carefully examined. In mainstream content area classrooms, pedagogical interventions which address the power dynamics among students have been examined. For example, Bunch (2006) investigated the effects of Complex Instruction, which attempts to balance the power dynamics among ELLs and non-ELLs by creating contexts which require multiple forms of contributions or by the teacher's affirming contributions from marginalized students in regular classroom contexts. This study found that ELLs who identified as being fluent in conversational proficiency, but limited in academic proficiency, were still able to access a wider variety of language practices and hence access the advanced curriculum in group work settings. These studies suggest the importance of considering learners' social identities and power dynamics when teaching and learning in a classroom, especially in linguistically diverse classroom contexts.

LEARNING AND TEACHING IN MULTILINGUAL MATHEMATICS CLASSROOMS: OVERVIEW OF RESEARCH IN MATHEMATICS EDUCATION

In mathematics education, recent educational reform emphasizes that all students have access to high quality, engaging mathematics instruction (National Council of Teachers of Mathematics,

2000). Partially because there is a commonly held belief that mathematics is a language-free subject, there has been less classroom research conducted on ELLs' access to mathematics learning, compared to other subjects (Gutiérrez, 2002). In recent years, there is a growing body of research in mathematics education to examine the issue of ELLs' access to high quality instruction (e.g., Barwell, 2005; Gutiérrez, 2002; Moschkovich, 2002; Secada, 1996). For example, Gutiérrez (2002) shows that teachers' non-essentialized view of learners can lead to effective pedagogical and linguistic organizations of the classroom, even when teachers do not share racial and linguistic backgrounds with the students. In the particular high school researched in the study, a large number of academically marginalized Latina/o students took advanced mathematics courses. In their classrooms, the teachers' beliefs were reflected in bilingual practices, including students' use of Spanish and English for mathematical meaning making, and building on student's familiar knowledge domains.

Another topic of research in mathematics education in relation to language is the investigation of intrinsic effects (i.e., connection between bilingualism and mathematics cognition) and extrinsic effects (i.e., aspects of culture influencing the development of mathematics cognition) of language on mathematics learning (Saxe, 1988). In line with this research, Civil (2007) led the Funds of Knowledge for Teaching Project in mathematics context, where researchers examined the ways in which mathematics instruction can draw from historically and socially accumulated body of knowledge embedded in family practices. In the project, students used their practical reasoning to learn school mathematics, based on their own knowledge as well as their households' knowledge.

As described above, research in the areas of applied linguistics and mathematics education has focused on linguistic and mathematical aspects of multilingual content classrooms

respectively. This dichotomy of content and language can be problematic considering students can experience both processes of learning simultaneously (Barwell, 2005). In order to reconsider ELLs' learning in multilingual content classrooms from this perspective, I draw on the situated multiliteracies approach by integrating insights from the sociocultural theory of learning and the theory of multiliteracies.

THEORETICAL FRAMEWORK: SITUATED MULTILITERACIES APPROACH

Perspectives on Language Learning in Mathematics Classrooms: Sociocultural

Theory of Learning

The human mind, according to sociocultural theory, is perceived as being mediated by physical and symbolic tools (Vygotsky, 1986). Because of this basic assumption, researchers drawing upon sociocultural theory analyze learning in its contexts: “what is around to be learned, in what circumstances, and to what end” (McDermott, 1993, p. 277). Learning should be understood in relation to its surrounding contexts, rather than separating the learner from the particular context (Gutiérrez & Rogoff, 2003). Drawing from this theory, researchers in second language education re-examined the mainstream second language learning model, which is largely influenced by the Information Processing Model and reduces contexts into sources of information (Lantolf, 2006; Swain, 2000; van Lier, 2000). For example, “input” for language learning can be reconceptualized as “affordance” in the environment, which is “a particular property of the environment that is relevant –for good or for ill– to an active, perceiving organism in that environment” (van Lier 2000 p. 252). Language learning is thus an active process of “learning to perceive affordances (relationships of possibility) within multimodal communicative events” (van Lier, 2007, p. 53).

Another significant concept of sociocultural theory is that learning involves shifting participation (Lave & Wenger, 1991). From this perspective, learners are participating in classroom mathematics practices while developing a set of discourses which is the “situated language use in one social setting” (Cazden, 1988, p. 3). Specifically, learners use the appropriate discourses which are required to participate in particular mathematics practices (e.g., providing explanations and proofs). From the perspective of situated learning, learning a language is similar to discovering how to use a tool, and this process requires a learner to engage in social and historical practices that meaningfully use that tool (Brown, Collins, & Duguid, 1989).

Rather than reducing learners to passive recipients of a body of factual knowledge, sociocultural theory emphasizes a “comprehensive understanding involving the whole person” (Lave & Wenger, 1991, p. 33). Through shifting their participation in a community of practice, learners are simultaneously changing who they are (i.e., their identities). Thus, learning and identity are not separate entities, but are in a dialectic relationship. Identity is “a layering of events of participation and reification by which our experience and its social interpretation inform each other” (Wenger, 1998, p. 151). In the classroom context, this means, for example, that learning an academic language in mathematics classrooms is the process of changing one’s identity through the learner’s participation in the community which meaningfully uses the language. In this sense, the language to be learned in the classroom is not monolithic, but requires a multiple set of tools with which to participate in a particular community of practice. In order to further expand on this point, I incorporate insights from the theory of multiliteracies.

Perspectives on Language Learning in Mathematics Classrooms: Theory of Multiliteracies

What traditionally represents literacy in mathematics classrooms can be reconceptualized from multiliteracies theory (New London Group, 1996). By reconceptualizing the traditional notion of literacy, which refers to print-based reading and writing, multiliteracies theory proposes the idea of literacy as diverse semiotic activities, which is mediated by multimodal resources for meaning making. The theory emphasizes two aspects of multiplicity in teaching and learning: (a) contexts of culturally and linguistically diverse societies, where students bring multiple national languages into the classroom, and (b) multiplicity of communication channels and media. This latter aspect emphasizes the role of various modes of communication, including non-text based languages (i.e., various symbols, sounds, and visuals) and multiple languages other than the dominant language. Multiliteracies theory has been applied to classroom practices and has promoted diversity in language and communication mode (Cummins, 2009). The relevance and significance of multiliteracies pedagogies have been discussed in the mathematics education community (e.g., Clarkson, 2009), and a growing body of research highlights multimodal resources in classroom mathematics learning and teaching (e.g., Arzarello, Paola, Robutti, & Sabena, 2009; O'Halloran, 2005).

Multiliteracies theory can highlight teachers' and students' effective use of multimodal resources and multiple languages, which have been the primary focus in classroom learning. This theory can also shed light on students' acquisition of identity as a multimodal user. In conceptualizing the notion of identity, Block (2007) emphasizes the role of language identity, which is defined as "the assumed and/or attributed relationship between one's sense of self and a means of communication" (p. 40). Block maintains that language identity is perceived as a multimodal identity because communication embeds the use of multiple semiotic modes that are

beyond linguistic resources. This perspective is particularly informative in reframing ELLs in the classroom, in relation to their identity as multimodal users.

I integrate sociocultural theory and multiliteracies theory, as the situated multiliteracies approach. Sociocultural theory offers its concept of learning-in-situ, which emphasizes that learners are embedded in contexts and engage in shifting participation and shifting identities. Multiliteracies theory does not necessarily emphasize what learning is, but can be applied to enhance the concept of language. By using the situated multiliteracies approach, I refer to the integration of these two theoretical perspectives discussed above.

METHODOLOGY

This paper is based on a year-long ethnographic study of mathematics classrooms in an urban multilingual school. The school was located in an inner city and belonged to the largest school board in the province of Ontario, Canada. The school had approximately 450 students, with representation from more than 30 different language groups; 23% of the students were born outside Canada, and for approximately 53% of the students, English was not the language spoken in their homes. Students' first languages varied and the minority languages recognized by the teacher included Bengali, Cantonese, Farsi, French, Romanian, Russian, Spanish, Mandarin, Tamil, Urdu, and Vietnamese.

The school promoted innovative teaching and learning, which included honouring students' linguistic and cultural diversity. For example, there were picture books from different regions of the world in the library, and the classroom teacher also talked with students about important holidays or celebrations in different cultures during classroom discussions. Despite the high percentage of ELLs in this broader sense, ESL programs were only available to students

who were new to Canada (within one or two years of their arrival). This access to ESL programs is similar across all schools in the province.

I conducted research in two Grade 4 mathematics classes taught by Ms. Sally Wilson. Throughout the 2009-2010 academic year, I collected 45 hours of video data and conducted three interviews with Ms. Wilson. This paper focuses on two newly arrived ELLs, Daniel and Karim. They were both participating in ESL classes for language and social studies, but remained in their homeroom classroom for mathematics, French, and science.

Portraits of Daniel and Karim

Daniel came to Canada from Mexico. When he and his family immigrated to Canada, they first moved to Montreal and then moved to Toronto at the end of November, 2009. When he first arrived at the school, Ms. Wilson described him as knowing very minimal English. Daniel was fluent in Spanish and he used Spanish to communicate with his family members. He was also able to communicate in French because he lived in Montreal before coming to Toronto, Ontario. When Daniel first arrived, a teacher candidate, Mr. Diaz, was teaching in Ms. Wilson's classroom and was fluent in Spanish. Ms. Wilson asked Mr. Diaz to translate her instructions into Spanish for Daniel. Daniel also expressed himself in Spanish to Mr. Diaz and to other students who were able to speak Spanish or French. In Mexico, Daniel completed Grade 4, which was equivalent to his Canadian grade. He also attended school when he was in Montreal. Ms. Wilson noticed Daniel's strong computation skills.

Karim was originally from Afghanistan, but moved with his family to refugee camps in Pakistan before coming to Canada. He came to Canada in August, 2007. His first language was Farsi and he used Farsi to communicate with his parents. Karim had an older brother and an older sister, with whom he communicated in English. Both Ms. Wilson and the ESL teacher

expressed concerns about Karim's limited prior educational background and the lack of progress he had been making. Karim often called out to Ms. Wilson during the class and tried to get her attention. On some days, Karim shouted "this is easy" and showed his work to the teacher, during individual work. In contrast, on other days, Karim was less energetic and stared down at his desk or out the window during class.

Method of Analysis

I conducted two layers of analysis in order to highlight a variety of teacher-student interactions surrounding ELLs in a mathematics classroom. The first layer of analysis examined the frequency and characteristics of metalanguage interactions, which focused on the following linguistic forms: discussion about lexical meanings and grammar or error corrections pertaining to student language production.

The second layer of analysis was based on the situated multiliteracies approach, namely focusing on how ELLs' participation in classroom mathematics interaction was mediated by multiple physical and symbolic tools and the kinds of identities they accessed. For these analyses, I focused on whole class discussions, which took place in nine classes across the school year (i.e., three classes from each of the three academic terms). These discussions covered different topics, such as checking in-textbook problems, introducing a new topic, and discussing the results of group work. The interactions introduced in the following section were selected because they signified a shift in the focal students' participation and identities. Ercikan and Roth (2011) discussed that classroom research of this kind has an underlying assumption that "each case expresses the concrete possibilities of acting and understanding in a particular culture" (p. 239). In other words, each sample of classroom interactions can reveal important stories about

the particular classroom life. Thus, in the following section, I will introduce examples that are compelling with regards to the analytic points I make.

With this method of analysis, however, there is the risk of “hypertypification” (Erickson, 1992, p. 209) of one event (providing evidence of a few events which fit into researchers’ assumptions). In order to avoid this risk, I conducted a year-long participant observation with video data. By participating in the same classroom over a longer period of time, I identified both typical and atypical interactions. The excerpts introduced in the following section are considered to be typical interactions that took place in the subject classroom. Also, with the use of video data, I was able to repeatedly return to an event and could therefore, avoid hypertypification.

RESULTS

Meta-language interaction

During whole class discussions in mathematics classes, there were a limited number of metalanguage interactions, where the teacher and students talked about linguistic forms. In the focal lessons, 5.6% of the whole class discussion episodes (12 episodes) were identified as metalanguage interactions and 11 episodes were for confirming the meaning of mathematical terms (e.g., mode, pictograph, equivalent fractions, and capacity) and non-mathematical terms (e.g., population). One episode was for checking the spelling of a term (e.g., milliliter). There were both direct vocabulary teachings and teaching strategies for vocabulary learning (Coady & Huckin, 1997). In direct vocabulary teachings, the teacher takes a word out of context and teaches the meaning of a single word. Teaching learning strategies includes teaching the origin of the vocabulary, how to memorize a certain word, and teaching word associations.

In an interview, which took place at the beginning of the academic year, Ms. Wilson talked about her teaching strategy relating to ELLs, by focusing on vocabulary. For example, she said:

In patterning, it's so rich in language, trying to get through [to the students] that through the mathematics and trying to simplify the question that are being asked – but still talk about what's happening and pull the language out of them and decide, “Do I use the word ‘increase?’ ‘Adds?’ ‘Grows?’ Which language most makes sense?” (Interview with Ms. Wilson)

Based on this interview, it appeared that her main concern was to find the most appropriate and comprehensible words for ELLs. Ms. Wilson's concern is reflected in the practice of mainly focusing on vocabulary in language instruction during her mathematics classes. A typical vocabulary instruction observed in this class is seen in Excerpt 1.

Excerpt 1. Vocabulary instructions

1	T	Could anybody point to the scale?
2	T	The scale. <i>[Teacher moves next to Ajmal (a newly arrived ELL) and points to Ajmal's book]</i>
3	T	The scale, k? <i>[Teacher moves next to Daniel and points to Daniel's book]</i>
4	T	Do you see the scale? <i>[Teacher moves next to Sabina (a newly arrived ELL) and points to Sabina's book]</i> The scale, okay.
5	T	What is the scale? What does it tell you? What's its job?
6	T	Hatim?
7	Hatim	One sun...one sun equals two days.
8	T	Right, so one sun <i>[writes on blackboard]</i> – one picture of the sun, equals, two days. Okay? That are sunny <i>[sic.]</i> . Daniel?
9	T	One sun means two days, that are sunny <i>[sic.]</i> . If you see this on the pictograph <i>[writing on the board]</i> , how many days? <i>[Students raise hands – everyone at the table raises hand – except for Daniel]</i>

Note: “T” in the excerpts refers to the teacher.

As seen in Excerpt 1, even within the direct vocabulary instruction, the teacher provided a couple of linguistic options. For example, in utterance 5 in Excerpt 1, the teacher rephrased a particular question in many ways. Also, in other instances, the teacher explained the origins of

the vocabulary (e.g., the word, “pictograph,” comes from “picture” and “graph”), and wrote it down on the chart paper. In the above interaction, the teacher targeted newly arrived ELLs for vocabulary instruction. In fact, in utterances 1-4 in Excerpt 1, the teacher looked at newly arrived ELLs and pointed to the scale in their notebooks and specified to them that it was called a “scale.” This type of instruction, however, did not necessarily lead to the increased participation of ELLs. In Excerpt 1, even after the teacher’s instruction targeting Daniel, Daniel did not participate in the discussion even though other students were participating. From the situated learning perspective, learning mathematics cannot be detached from using mathematics discourse and therefore metalanguage interactions should be examined in relation to students’ participation in mathematics discussions. In the classroom, Ms. Wilson used other strategies in order to facilitate ELLs’ participation. As follows, drawing on the situated multiliteracies approach, I will demonstrate the context in which they successfully participated in classroom mathematics practices.

Situated, Multiliteracies Perspectives to Classroom Interactions

Use of first languages to enhance ELLs’ participation. How were different languages perceived and used in multilingual mathematics classrooms? In the following interview excerpt, the teacher, Ms. Wilson, described her intention of using students’ first languages, by focusing on Daniel.

Spanish was easier – my decision was based on the level that students were at. Daniel had only been in Canada for three months and he had limited English. I happened to have someone in the classroom as the TC (Teacher Candidate) who spoke Spanish. So, of course, you make great use of that and run with it. I obviously tried to pick up on [it] as well – to make Daniel welcome and to make him comfortable. (Interview with Ms. Wilson)

In linguistically diverse classrooms, there is a challenge to decide which languages to use, and when and how they should be used. The following interaction shows that even the teacher's non-extended use of the student's first language can help Daniel be positioned as a multilingual speaker, and provides the opportunity for Daniel to participate in the classroom mathematics discussion.

The following excerpt was taken from the introductory lesson about data management. Students were introduced to different types of graphs. Ms. Wilson explained the different types of graphs (e.g., pictograph, bar graph, and circle graph) and also defined each part of the graph for the students (e.g., scale, key, and axes). She brought a picture of each graph on chart paper, stood in front of the students, and asked questions about the names of each part of the graph. In the following interaction, the teacher initially asked Daniel to describe the shape of the graph. In response, Daniel answered "circle graph." Following this interaction, Ms. Wilson asked Daniel to say the word in Spanish, after which Daniel provided the word "círculo."

Excerpt 2. Use of first languages

1	T	What kind of graph is this?
2	T	<i>[Looking at Daniel]</i> Are you thinking? What kind of graph is this?
3	Brian	Circle graph.
4	T	How did you know that?
5	Brian	It's written there.
6	T	Yes, it says right here. It's my trick question of the day! I've asked you already, it's my trick question. It's a circle graph and it tells you that... <i>[Teacher makes a gesture of circle]</i>
7	Daniel	Um.... Circle graph.
8	T	Right. How do you say circle in Spanish?
9	Daniel	Círculo.
10	T	Círculo. Okay, so, it's a circle graph. Círculo is very close to circle, right? It's a circle graph.

The interaction can be characterized with an Initiation-Response-Evaluation pattern (Mehan, 1979). The teacher looked at Daniel and asked him for the name of the graph in front of everyone. In utterance 3, another student, Brian, answered the question, which was addressed to Daniel. As a result, Daniel was deprived of the opportunity to answer the question on his own and provided the exact same answer, which Brian had already provided. Daniel did not offer any new information. Subsequently, the teacher asked Daniel to say the Spanish equivalent word for a circle, and created the opportunity for Daniel to contribute to the collective knowledge of the class. In this interaction, we can observe the teacher's strategy to use Daniel's linguistic resources to include him as a contributor to the classroom discussion. In other words, Daniel contributed to the interactive space through the teacher's attempt to include his first language.

While the use of first language in whole class discussion was limited, Ms. Wilson maximized the resources available in the classroom so as to facilitate Daniel's participation. For example, Ms. Wilson arranged the classroom seating expressly for this purpose. Daniel was seated close to students who could speak French or Spanish. With this seating arrangement, students served as translators for Daniel (when necessary) during class. Because Daniel was able to use French and Spanish, he was positioned as multilingual, even though he could not yet speak English fluently.

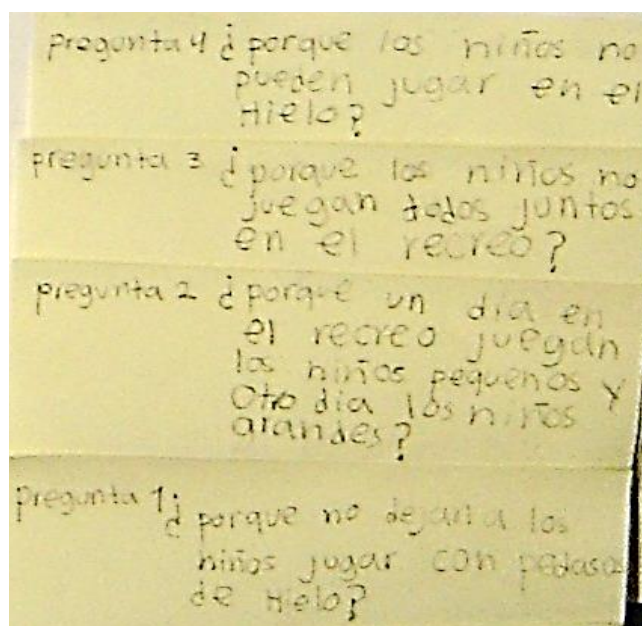
Students started to work individually or in pairs. Daniel was not opening a textbook. So, I asked him to open the pages 2-3. Then, I asked him if he knew the word, "light." He said "yes." I continued to ask him, "Where can you see lights?" He did not respond. I said to him, "Inside the house." In order to describe the concept of "inside the house," I made a gesture and indicated the enclosed place with my arms. Ross, who was sitting next to Daniel, talked to me: "He doesn't speak English. He only speaks Spanish or French." Laura, who was also sitting next to Daniel, told me that "I speak Spanish." Ross then said, while pointing Iris, "And she can speak French." I asked Laura if she could translate what I would like to say for Daniel, into Spanish. Laura said "yes." (Fieldnotes 01/07/2010)

Thus, Daniel's seating arrangement represented Ms. Wilson's discourse on language use. She tried to maximize Daniel's resources in the classroom. In this context, Daniel's fluency of Spanish and French was acknowledged by his peers and Daniel was positioned as a multilingual student. As Toohey (2000) demonstrates, the social organization of the classroom, including seating arrangements, can influence students' language learning opportunities. In Ms. Wilson's class, Daniel's seating arrangement enhanced Daniel's opportunities to participate in mathematics classroom interactions, as demonstrated in the following interaction.

During the data management unit in the mathematics curriculum, the teacher designed lessons around the principles of participatory action research (Camarota & Fine, 2008), which maintains that research should be led by the interests of those who are affected most by the research. The teacher integrated this participatory action research principle into her mathematics lessons on data management and thus elicited students' interests. In the first lesson of this unit, Ms. Wilson used the lesson to brainstorm ideas and write down thoughts about the playground in general. She provided post-it notes to students and asked students to write down as many ideas as possible. Students individually wrote down ideas on the notes, and then shared them with others. Ms. Wilson allowed Daniel to write down his ideas in his first language (Spanish) and asked a classmate to translate them from Spanish to English.

Because the topic of the playground was something familiar to all students, including Daniel, who had recently joined the class, Daniel was able to propose questions that could be developed into survey questions. In fact, some groups addressed survey questions that were similar to Daniel's ideas (e.g., "Why aren't kids playing together in the playground?" and "Why

can't little students and bigger students play on the same day?"). Thus, under the guidance of the teacher, Daniel was able to propose his ideas in Spanish (Figure 1).



Question 4. Why can't we play on the ice?

Question 3. Why aren't kids playing together at recess?

Question 2. Why can't little kids and bigger kids play on the same day during recess?

Question 1. Why can't children play with pieces of ice?

FIGURE 1 Daniel's contributions in Spanish (English translations were added).

With the presence of the teacher, the interactions were carefully controlled and students in the small group had a chance to share their ideas. Ms. Wilson encouraged Daniel to propose his ideas in Spanish. Because there was another student who could speak Spanish, Daniel's ideas were written in Spanish and were translated into English and thus his ideas were understood by the teacher and other students. Occasionally, Ms. Wilson used short phrases in French to praise

Daniel's answer (e.g., "très bien" [very good]). This teacher's use of multiple languages sent a message that multiple languages were allowed in the classroom and thereby led to Daniel's enhanced participation.

Enhanced participation through the use of multimodal resources

In Ms. Wilson's classroom, ELLs' use of multimodal resources was considered to be a significant part of their contribution. Excerpt 3 depicts Karim's use of multimodal tools, and how this was important in helping him explain his ideas. In the following example, the teacher showed the class a picture of a rectangle divided into four equal parts. She then coloured in three of the parts and asked students to name the corresponding fraction. While the teacher was expecting the answer " $\frac{3}{4}$," Karim instead offered " $\frac{6}{8}$ " as his answer (Please see Figure 2). In building on Karim's answer, Ms. Wilson followed up with a classroom discussion (utterance 7) to ask Karim to elaborate on his ideas and also extended the topic to discuss the notion of equivalent fractions.

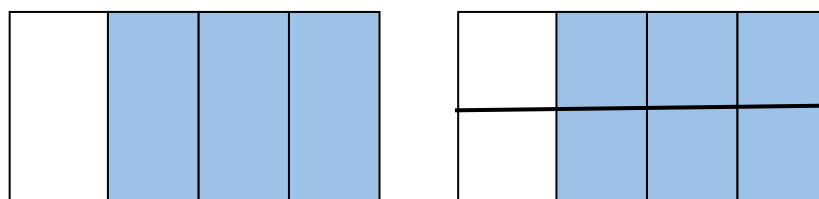


FIGURE 2 Fraction models by the teacher (left) and by Karim (right).

Excerpt 3. Use of multimodal resources

1	T	<i>[drawing on hanging paper]</i> How about this one? Not very even. Pretend the line is here. Not there. 'kay? <i>[drawing a square divided into four pieces and coloring three of the pieces]</i>
2	T	What would you say about this one?
3	T	Karim?

4	Karim	Two out of eight.
5	T	Two out of eight?
6	Karim	Hey, no...six out of eight.
7	T	Six out of eight, show us, show us.
8	Karim	<i>[going up to front of the class]</i>
9	Charlie	<i>[whispers to a student next to him]</i> It's four.
10	Karim	There is eight altogether <i>[finger gesture - pointing to the whole]</i> and you coloured in six of them. <i>[finger gesture - pointing to the parts that were coloured]</i>
11	T	Point to the eight. Point to the eight and show us.
12		<i>[Karim - finger gesture - pointing to eight equal parts]</i>
13		<i>[T counts while Karim is pointing]</i> two, three, four, five, six, seven, eight.
14	T	You are very clever.

Through this exchange, visual representation is treated as an important aspect of mathematics discourse. In this interaction, Karim was able to *show* his thought-processes by pointing to the eight equal parts that he visualized in the picture, and six of the parts that were coloured in. Ms. Wilson acknowledged what Karim described, and praised his contributions.

In this episode, the multimodality of mathematics discourse was evident; the teacher and students were communicating the notion of fractions with visual representations, and students were asked to show their mathematical thinking with the use of these representations and gestures. In the above interaction, the use of gestures and visual representations was considered to be a significant resource to enhance communication. In this context, Karim's contribution was perceived as being significant.

This episode also provides an example of how acknowledging the multimodality of mathematics discourse and students' multimodal identity can lead to ELLs' enhanced participation in the classroom, even before their acquisition of mathematical vocabulary. In this introductory lesson on fractions, students were still learning mathematics-specific vocabulary,

such as “denominator,” “numerator,” and “equivalent fractions.” Visual representations served an important role for Karim; he used them to support his verbal explanations of his thought processes. In terms of acquiring mathematics vocabulary, Karim’s explanation can be seen as not being fully competent because he was not using the appropriate mathematics vocabulary (e.g., denominator, numerator, and equivalent fraction). However, from the situated multiliteracies approach, the tools for participation were not just limited to verbal interactions; non-verbal discourses, such as visuals and gestures, were also considered to be important tools. Thus, the interaction above will be considered as successful participation in the mathematics discourse practice of justifying one’s answer.

Another significant aspect of the above interaction was that the ELLs were positioned as important contributors to knowledge building. While Karim’s answer was not what the teacher expected, the teacher praised Karim’s idea by recognizing it as a vital contribution. This point is particularly meaningful, given that racial and linguistic minority students historically tend to have difficulty receiving affirmation or validation for their contributions in the traditional classroom discourse (Harklau, 1994; U.S. Commission on Civil Rights, 1973).

In terms of mathematics language learning, the above episode indicates that Karim’s visual contributions were elaborated into abstract mathematical language by the teacher. As Gibbons (2006) maintains, the classroom discourse functions to bridge the gap between more situated, everyday languages and less situated, academic language. Following the interactions as set out in Excerpt 3, the teacher connected Karim’s idea with more abstract language specific to mathematics (i.e., equivalent fractions), and wrote down the newly introduced word “equivalent fractions” on chart paper. This type of interaction created a meaningful context for integrating

the learning of a new academic, mathematics-specific word and mathematics ideas presented by an ELL student.

Implication of Situated Multiliteracies Approach for All the Students

The results above demonstrated how instructional contexts highlighted by the situated, multiliteracies approach led to the successful participation of ELLs. The following example shows how the teacher's modification of instructional contexts enhanced the participation of other students as well. In other words, by underlining the enhanced participation of students, other than newly arrived ELLs, I illustrate how the teacher's modification of contexts attending to newly arrived ELLs promoted diverse ways of participation for all the students. The use of multimodal resources in mathematics instruction was particularly important considering that English was not the first language for the majority of the students in the subject school.

The following interaction highlighted students' learning of the conditional pattern. The conditional pattern consists of a conditional phrase (e.g., "if...") and a result phrase (e.g., "then..."), and is a discourse practice used when examining the relationship between two different variables (Moschkovich, 2007). The following excerpt (Excerpt 4) shows the type of discourse valued in Ms. Wilson's mathematics classes. In this excerpt, the class was discussing the following word problem:

Simon wants to build a rectangular pen for his potbelly pig, Smily. Simon has 22m of wire mesh to enclose his pen. Simon wants the greatest area possible.

In Excerpt 4, two students, Amir and Michael, were acknowledged by the teacher to have logically solved the problem and were thus given a chance to explain their thinking process in front of the class. For this problem, Ms. Wilson highlighted the problem solving strategies employed by Amir and Michael, who used a visual model to solve the problem. Amir and

Michael made a presentation on their problem solving strategies, while using a model of their thinking process (please see Figure 3).

Excerpt 4. Use of multimodal resources

1	Amir	Different areas...
2	Michael	Can we talk about the pattern?
3	T	Yes
4	Michael	Ah, well, if A was a line on the wall, you could see, um, every square would, if you had A on the wall, would go down and then, it would be that and then, it would move one square over and then, you would keep doing that.
5	Amir	It'd be like stairs if you look at it like this, like most stairs are...
6	T	So, talk about the...what happened with length and width. <i>[with gesture showing length and width]</i> So just say that one more time.
7	Amir	If the width would get bigger, the length will get shorter.
8	T	<i>[nodding]</i>
9	T	So, they went from long skinny, right? <i>[gesture showing a long skinny rectangle]</i>
10	T	And the width got shorter and they knew they had to made it longer. Why did you have to make sure if you got shorter, you got... if you went longer with the width, the shorter the length is, why is that?
11	Amir	Because if you only do the length shorter, it would be, ah... smaller perimeter than what it should be.
12	T	Exactly. So, perimeter had to stay the same. Was it possible to have different areas with the same perimeter?
13	Ss	Yeah
14	T	Think everybody could answer the question.
15	Ss	Yes (students in unison)
16	T	Good. Alright.

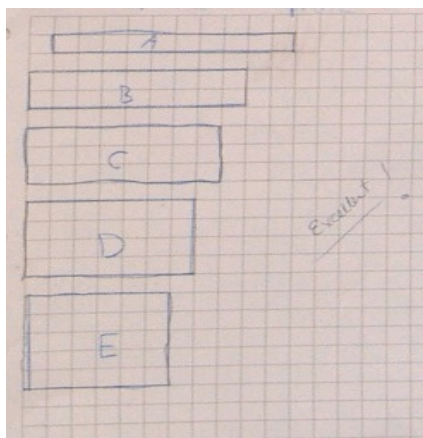


FIGURE 3 Amir and Michael's model.

The interaction in Excerpt 4 shows that Amir and Michael used a model to explain the pattern that they identified. While Amir and Michael explained their problem solving strategies verbally, it is noteworthy that Ms. Wilson acknowledged the use of a model as a valid mathematical explanation. For example, their visual models supported the explanations provided by Michael and Amir (e.g., utterances 4 and 5). Ms. Wilson also used gestures to describe a visual model when asking questions (e.g., utterances 6 and 9). In addition, Ms. Wilson supported the conditional pattern of discourse by asking students a prompt question regarding the relationship between width and length (e.g., utterance 6). Subsequently, Amir described the relationship between the two variables: “if the width would get bigger, the length will get shorter” (e.g., utterance 7). Eventually, these interactions mediated by multimodal resources led to the collective understanding of the relationship between area and perimeter. Drawings, models, and other multimodal methods are central to mathematics discourse and serve a significant role in problem solving, as well as in expressing mathematical thinking (O'Halloran, 2005). From this perspective, it can be seen that students, including ELL students, accessed mathematical discourse even before they accessed verbal explanations of their thinking processes.

DISCUSSION

I highlighted the interactions in which ELLs successfully participated in classroom mathematics practices, by integrating the theoretical framework of sociocultural theory and the theory of multiliteracies. The interactions presented in this paper demonstrated that the teacher recognized multiple physical and symbolic tools that an ELL student used and affirmed the student's identity as an important contributor in the classroom community. The results showed that metalanguage interactions were not very common in mathematics classrooms. Where metalanguage interactions took place, negotiation of lexical meanings and introduction of new vocabulary were the main topic of conversation.

This finding about vocabulary instruction in content area classrooms is consistent with previous research, which revealed that the majority of language interaction in content area classrooms targeted vocabulary development (Pica, 2002; Short, 2002). I will discuss this finding in the following two aspects: (1) vocabulary instruction and ELLs' identities, and (2) teacher professional development in content area classrooms. In response to this prevalence of vocabulary instruction, Moschkovich (2002) distinguished three views of multilingual learners in mathematics classrooms: (1) focusing on vocabulary, (2) focusing on multiple meanings and (3) focusing on participation. Moschkovich maintained that the former two prevailing views of multilingual learners tended to emphasize linguistic minority students' language deficits rather than their existing knowledge and resources. The situated multiliteracies perspective offers an alternative approach to conceptualize multilingual learners in content classrooms by affirming both the multiple tools mediating mathematical concepts and the learners' identities in the classroom community of practice. My account of Ms. Wilson's classrooms highlights some of

the ways in which newly arrived ELLs successfully participated in mathematics practices even before they acquired mathematics terms or discourse.

As Ms. Wilson's interview data suggested, vocabulary instruction can be considered the first remedy for ELLs' problems in content area classrooms and the type of language instruction that mainstream content area teachers apply, even without professional development on language instruction. The prevalence of vocabulary instruction for ELLs in content area classrooms can be due to the dearth of current opportunities for the professional development of mainstream classroom teachers (Lucas & Villegas, 2011).

Instruction which targets ELLs' development of language and content is not limited to lexical instruction, and the teacher should be prepared with "pedagogical language knowledge" (Bunch, 2013, p. 299) that is tied to the teaching of content knowledge. As an initiative to overcome the limitations in language instruction in mainstream content classes, researchers have examined possible interventions to develop a wide range of language and subject-area knowledge. For example, in sheltered instruction, Echevarria, Short, and Powers (2006) demonstrated the positive effects of instructional intervention on ELLs' performance in literacy achievement tests. Their instructional interventions (the Sheltered Instruction Observation Protocol (SIOP) model) included the teacher's modification in speed and clarity of his/her speech, targeted vocabulary instruction, and adaptation of instructional materials. From the situated, multiliteracies perspective, increasing teacher professional development opportunities for teaching ELLs in content area classrooms will be meaningful not only for extending teacher-guided linguistics practices but also for developing a wider repertoire of identities for ELLs. Findings from this study also helped to reassess the integration of language and content. As Barwell (2005) has argued, "language" and "content" in mainstream content classrooms tend to

be conceptualized as fixed bodies of knowledge in the area of research addressing the issue of language-content integration. Barwell called for an approach to conceptualize students' simultaneous learning of language and content. For example, in the current study, Karim was able to point out the equivalence of two kinds of fractions by using his gestures and visual representations, before acquiring the mathematical terms to explain the concept. The teacher seized this moment and introduced both the concept and the term of "equivalent fractions." The situated multiliteracies approach also highlights the ways in which Karim's identity as a competent learner was constructed.

The issue of identity is crucial in relation to the use of first languages in mainstream content area classrooms. In K-12 school contexts, there is still a belief that linguistic minority students' first languages should not be used in order to maximize their exposure to English, even though research has shown that bilingual instructional strategies can in fact scaffold ELLs' accomplished performance (Cummins, 2007). Ms. Wilson's teaching approach was progressive in that she allowed her students to use non-English languages in her linguistically diverse classroom. As described above, while the opportunity was limited, Ms. Wilson tried to use an ELL student's first language in whole class discussions and demonstrated the student's multilingual and multimodal identities in front of the other students. In order to further facilitate students' use of various languages, Ms. Wilson placed a newly arrived ELL student who spoke Spanish and French in a group of students who could speak Spanish and French. This eventually led the newly arrived ELL to be positioned as multilingual in the classroom.

Further examination of the quality of first language use, both in whole class discussions and in group work, will be beneficial in discussing the role of non-dominant languages in linguistically diverse content area classrooms. In classrooms where students of various first

language backgrounds participate, there can be an additional layer of complexity for students' first language use, compared to classrooms where linguistic minority students share a common first language. For instance, Enyedy et al. (2008) conducted a study in a secondary multilingual mathematics classroom that included Spanish speaking students and African American students who did not speak Spanish. The teacher was concerned about marginalizing the participation of these African American students when conversations were held in Spanish. This issue regarding linguistic dynamics should be further examined to address the issue of how teachers can create multilingual learning environments in content area classrooms within the broader educational system, wherein there is more than one dominant language

By taking the situated, multiliteracies approach, this study demonstrated the possibilities of enhancing ELLs' participation by validating the use of multimodal resources in mathematics classrooms. Further research will be beneficial in examining the use of multimodal resources in content area classrooms other than mathematics classrooms, where multimodal models tend not to be considered as common instructional practices. The interactions highlighted in this paper suggest the ways in which students' mathematics discourse was enhanced by acknowledging the use of multimodal resources. These accounts collectively challenge widespread perspectives regarding teaching strategies with ELLs, which tend to overemphasize their linguistic deficiencies, rather than maximize their existing resources.

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